

fibro-vascular tissue than in the normal scale. In the rudimentary leaves and summit of the stem there are neither resin-ducts nor mycelium during the winter. Resin ducts develop earlier in the season in the cortex of the twigs of the "broom" than in normal twigs, and they are always present in greater numbers in the former than in the latter.

In the cortex of the "witch broom" tumor it occasionally happens that the communication by way of resin ducts between the diseased parts above the point of infection and the healthy parts below it is broken. Ducts are never formed in the phloem, while in the wood they are present in every annual ring. The diameter of these ducts and their number are greatest at the middle part of the tumor. From this point toward either end the diameter, number, and number of epithelial cells in each, diminishes. At the lower end all the ducts are pointed and terminate between diseased and normal wood. In the upper extremity all ducts which end with the tumor are pointed. Ducts seem to occur as often in the wood of healthy twigs having their origin above the point of infection as in that of the diseased ones. In the wood of the tumor there is usually, in each annual ring, a circle of ducts and sometimes two such circles.

Tissues of *Picea excelsa*, *Pinus Strobus*, and *Larix Japonica* infected with *Agaricus melleus* show that there is an increase in the number of vertical ducts in the diseased wood ring in all parts of the plant above the point of infection. The greatest increment of wood in the diseased ring is found in the upper part of the plant, from which downward the thickness of the ring decreases. With this decrease in thickness there is a corresponding increase in the number of resin ducts per square unit of section surface. In *Abies pectinata* infected with *Phoma abietina* resin ducts occur only in the healthy wood above the diseased part of the branch. These ducts are similar to those in the wood of the "witch broom" on *Abies*. Tissues of *Abies pectinata* and *Picea excelsa* infected with *Pestalozzia Hartigii* show in the former the formation of abnormal ducts only in the sound wood above the diseased part of the stem and in the latter the formation of a larger number of ducts in the healthy wood above the diseased part of the stem than is found in normal spruce wood.—L. S. CHENEY.

#### The sensibility of plants.

PHYSIOLOGISTS are engaged in the effort to bring the phenomena of sensibility of the plant and animal into a system with uniform terminology. One group of writers insist upon the elevation of the forms of sensibility of the plant to the dignity of senses, coordinate with those of the animal. A second group, basing their conclusions upon the reflex nature of the reactions of the plant, see nothing in them beyond highly specialized forms of irritability.



The text of a recent popular address by Dr. Noll is of interest in this connection.<sup>2</sup> The popular superstitions and fanciful theories of the intelligence, spiritual life and sensibility of plants since the time of Empedocles (fifth century B. C.) are brought into review in the light of modern investigation, and following a summary of the results upon which the current theories of irritability are based, the author enters upon a highly metaphorical discussion of the true nature of the sensibility of plants. Defining a sense he says: "The ability to feel the relations of the surrounding world, or objectively expressed, to receive these relations as stimuli, and react by variations in the life processes, is to be designated as sense." Psychologists are not so easily satisfied, however. With such definition as a basis the author proceeds to the statement, "that portions of plants are to be recognized, which not only *can*, but *must* be designated as *sense organs*." To term the pulvinus of *Mimosa* a specific sense-organ does not attain the advantage of inclusion of similar things under single terms as claimed by the author.

It is to be seen that the greater portion of the paper was not meant to be taken too seriously or literally by the audience to whom it was addressed, for in the concluding paragraphs it is pointed out that the presence of consciousness or of any of the psychic functions of a centrally organized nervous system has not been demonstrated in plants, and therefore that real senses are wanting, since a reflex connection of the motor and sensory zone meets every necessity of existence. Weber's law of the relation of stimulus to reaction, once thought to be a test of the presence of consciousness, has been found to apply to some reactions of plants, but since it is possible to construct a machine which will obey this law, it has lost its significance in this connection.

The author has appended a series of critical notes on the various questions suggested in the lecture. An interesting comparison is made of the greater degree of perfection of the sensibility to gravity in the plant, with the function of the otocyst in lower, and the semi-circular canals of the ear in higher animals. Great importance is attributed to the interprotoplasmic threads in the conduction of impulses, though the writer does not seem aware of the fact that the interruptedness of the nervous tissue of animals is universally accepted. In harmony with the work of the reviewer the curvature of tendrils in response to changes in temperature are not regarded as reactions in the same sense as those to contact, etc.

A discussion is given of Czapek's objections to Noll's theory of the irritability of secondary roots, and of Pfeffer's adverse criticisms of certain phases of "heterogene Induktion," but no new facts are adduced. The value of figurative discussions of the nature of the irritability of plants is extremely doubtful. In no part of the subject is it more necessary to keep the feet on

<sup>2</sup>Das Sinnesleben der Pflanze. Sonderabdruck a. d. Ber. u. d. Senkenbergische Naturf. Ges. i. Frankfurt, a M. 1896. Vortrag gehalten 31 Mai, 1896.



solid ground, and advance should be made from fact to fact only. Popular literature is quite full enough of fanciful conceptions of plants without additions from the laboratory.

The entire paper, however, will be interesting reading to that class of biologists who profess to see in plants a series of degraded forms, which began retrogression on the acquisition of the habit of fixation.—D. T. MACDOUGAL.

### MINOR NOTICES.

THE CŒUR D'ALENE mountains of Idaho have long been known as interesting botanical ground. All of northern Idaho presents that combination of conditions which has resulted in an unusual flora. During the summer of 1895 Mr. John B. Leiberg undertook a botanical survey of the Cœur d'Alenes, under the direction of the Division of Botany, of the Department of Agriculture. This survey was the more significant and fruitful as Mr. Leiberg had lived in northern Idaho for about ten years, and was already very familiar with the region. A contribution<sup>3</sup> just published gives us some of the results, dealing with matters both biologic and economic, as follows: topography, drainage, climate, mineral deposits, agricultural capacity, agricultural products, grazing lands, native food plants, utilization of water supply, forest resources, forest zones, forest destruction, burned areas, forest preservation, and a new system of timber protection.—J. M. C.

RECENT BULLETINS from the experiment stations embrace a variety of botanical subjects. E. J. Durand (Cornell no. 125) describes a disease of currant canes observed in New York and New Jersey not before noted in this country. Three fungi were found: *Tubercularia vulgaris*, *Nectria cinnabarina* and *Pleonectria berolinensis*, of which the first two are the chief or only cause of the disease, and also are undoubtedly forms of one species. Little was accomplished with cultures and inoculations. A. S. Hitchcock (Kans. no. 62), in thirty-four pages and ten plates, gives much information about two species of corn smut (*Ustilago*). Successful infection experiments were made. A. D. Selby (Ohio no. 73) briefly describes and illustrates a number of fungous diseases of the forcing house and garden. R. H. Price (Texas no. 39) gives a general account of the peach, including notes of botanical interest on diseases and on the five classes. A popular account of bacteria and their study is presented by C. E. Marshall (Mich. no. 139) in thirty-seven pages. Three troublesome weeds: *Hieracium aurantiacum*, *Daucus Carota* and *Solanum rostratum*, are briefly described by F. L. Harvey (Me. no. 32). Geo. Vestal gives a popular account of the care and handling of seeds (N.

<sup>3</sup> LEIBERG, JOHN B.—General report on a botanical survey of the Cœur d'Alene mountains in Idaho during the summer of 1895. Contrib. Nat. Herb. 5: 1-85. 1897.